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AIR TRANSPORT
OF
WHEELCHAIR BATTERIES

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Prepared For
Transportation Development Centre
Transport Canada

By
T E S Limited
Ottawa, Canada

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The contents of this report reflect the views of the contractor and not necessarily the official views or policies of the Transportation Development Centre.

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17. Abstract

Persons using electric wheelchairs equipped with wet electric storage batteries are presently restricted to flights on wide body aircraft due to loading and tie-down restrictions. This report examines the problems involved and evaluates options intended to improve the accessibility of airline travel for electric wheelchair users. Options including loaner batteries at the destination airport, non-spillable batteries, special shipping containers and non-spill vent plugs are considered. The options are ranked as to their suitability for ensuring that air travellers with electric wheelchairs have full use of their wheelchairs at the destination airport. The special packaging option is the one that best fulfills this requirement. It is recommended that the service trial of the Air Canada packaging process be monitored.

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17. Résumé

Présentement, les handicapés qui se déplacent en fauteuils roulants électriques mûs par accumulateur à électrolyte liquide ne peuvent voyager que par avion gros porteur dû aux restrictions touchant le chargement et l'arrimage de leur fauteuil dans la soute à bagages. Le présent rapport étudie les problèmes que pose le transport de ce type de fauteuil ainsi que les solutions proposées pour faciliter aux personnes en fauteuils roulants électriques l'accès au transport aérien. Les options suivantes sont envisagées: un système de prêt de batteries à l'aéroport de destination; l'utilisation d'accumulateurs étanches ou à bouchons anti-débordement et enfin, les accumulateurs actuels des fauteuils roulants pourraient être transportés sous emballage spécial. Ces solutions ont été considérées en vue d'assurer aux personnes en fauteuils roulants électriques l'usage de leur fauteuil dès leur arrivée à destination. La meilleure solution semble être d'opter pour l'emballage spécial. La période de mise à essais de ce service par Air Canada devrait être un sujet d'analyse de sa praticabilité, selon la recommandation du rapport.

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SUMMARY

This report investigates the problems associated with the air transportation of electric wheelchair batteries. At present, wet electric storage batteries can only be carried on wide body aircraft because of loading and tie-down restrictions. The objective of the report is to assess alternative means for ensuring that air travellers with electric wheelchairs have full use of their wheelchairs at the destination airport.

In order to define the problem, current practice and regulations, as well as proposed regulation changes, were reviewed through contact with regulatory agencies, airlines, and a consulting occupational therapist. Battery and wheelchair manufacturers and distributors were contacted to determine the types of batteries in use and their views on options such as alternative non-spillable batteries and non-spill vent plugs. Requirements for the safe transportation of batteries were laid out in order to facilitate the evaluation of four proposed options. The options considered included a loaner batter system, non-spillable batteries, special shipping containers, and non-spill vent plugs.

The four options were ranked as to their suitability for meeting the requirements of the objective of the report. The design of a special shipping container was deemed to be the most suitable alternative.

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1. INTRODUCTION

The purpose of this study is to investigate the air transportation of electric wheelchairs. The majority of electric wheelchairs utilize wet electric storage batteries, which contain corrosive electrolyte. In the event of spillage of this electrolyte, a potentially hazardous situation can result, especially during air transportation. For this reason, regulations governing the air transportation of electric wheelchairs restrict the method of transporting these batteries. Unfortunately, these regulations also limit the mobility of electric wheelchair users.

Present practices, regulations, types of batteries in use, and criteria for the safe transportation of electric storage batteries are examined with respect to the four options proposed by the Transportation Development Centre (TDC). These options include:

a) Availability of replacement wet-cell batteries at destination
b) Alternative non-spillable batteries
c) Special shipping containers for wet-cell batteries
d) Special non-spill plugs for wet-cell batteries

An assessment of each option is presented and from these assessments, the options are ranked as to their suitability for ensuring that air travellers with electric wheelchairs have full use of their wheelchairs at the destination airport.

2. CURRENT PRACTICE

2.1 Regulations

2.1.1 Present Regulations

The governing regulations in Canada are those as set out by the International Air Transport Association (IATA). These regulations are accepted or recognized in sixty countries and are published in IATA's Restricted Articles Regulations, 23rd Edition (December 1980) and its Supplement and Amendment (March 1981). A notable exception to the list of participating countries is the United States where the air transportation of dangerous goods is covered in the Code of Federal Regulations (49 CFR). Also, as noted in the Supplement and Amendment (March 1981), IATA will be instituting changes to provide a more gradual and easier transition to the proposed International Civil Aviation Organization (ICAO) Technical Instructions, which are almost entirely based on U.N. recommendations. However, such items as the U.N. packaging group system, packaging specifications and packing notes, as well as quantity limitations per package will not be adopted by IATA at this time. It is expected that the 24th Edition will have a publication date of 1 January 1982 and become effective 1 July 1982.

The basic principle of the present IATA regulations, as they apply to the transportation of electric wheelchairs and their storage batteries, is that no undue safety hazard shall be created. In the case of a wheelchair using wet electric storage batteries, the batteries must be securely fastened in the wheelchair battery tray, the electric power cables disconnected, and the battery terminals positively protected against short circuit. The wheelchair must then be loaded and secured in an upright position in the cargo hold. Due to space and tie-down limitations, the requirement of loading and securing the batteries and wheelchair in an upright position can only be met on wide body aircraft such as the 747 or L-1011. On narrow body aircraft, transportation is not permitted. Wet electric storage batteries can be transported on cargo only flights if removed from the wheelchair and properly packaged to ensure transportation in the upright position and to prevent damage.

The regulations also refer to wet electric storage batteries, non-spillable type. Non-spillable batteries are described in the IATA regulations as being "...designed and constructed so as to positively prevent leakage of the electrolyte, irrespective of the position of the battery. This is achieved by the use of jelly type electrolyte or porous absorbent separators or by specially designed filling and venting devices." In electric wheelchair use, a non-spillable designation is normally achieved through the use of jelly type electrolyte. Batteries of this construction are commonly referred to as gel cells in the wheelchair industry. Gel cells are accepted for transportation in wide body aircraft under the same conditions as conventional wet electric storage batteries; however, if removed from the wheelchair and properly crated to protect against damage, gel cells can be also transported on narrow body aircraft.

2.1.2 Proposed Regulation Changes

For completeness, this section will address regulation changes proposed by the United States Department of Transportation in the Federal Register, Vol. 46, No. 107, June 4, 1981, which deals with the requirements for the transportation of wet electric storage batteries.

For wet electric storage batteries, the proposed rule changes would allow their transportation in upright containers utilizing absorbent packing material, on aircraft where upright loading and securement of the wheelchair with the battery installed is not possible. These containers would be made tilt proof either by securing them to a pallet or by a method of positive securement.

The proposed changes also address the definition of the term non-spillable wet electric storage battery. The classification of non-spillable would apply to battery types capable of meeting the requirements of two specified tests. These tests call for no leakage of electrolyte under conditions of vibration and pressure differentials considered normally incident to air transportation. The proposed changes would not require that non-spillable batteries be boxed if securely attached to the wheelchair.

In summary, these proposed changes should facilitate the mobility of wheelchair users by permitting wheelchair batteries to be carried in a manner not now accepted, as well as clarifying the requirements applicable to electric wheelchair transportation.

2.2 Wheelchair User Practice

As the present Canadian regulations apply, electric wheelchair users with wet storage batteries are limited to flights on wide body aircraft. Users with non-spillable wet storage batteries are also allowed on narrow body aircraft if the batteries are removed and properly crated to protect against damage.

The majority of wheelchair users with wet electric storage batteries wishing to travel to destinations not serviced by regular wide body flights have a limited number of options. The first option is to leave their electric wheelchair at home and travel with a manual chair and an attendant. This of course essentially doubles the cost of the trip as the attendant's air fare, accommodation etc. must be covered. Also, the wheelchair user loses the independence associated with an electric wheelchair. Another option is to leave the original set of wet electric storage batteries at home and arrange to have a second set available at the destination. Again, this option adds cost to the trip as the batteries are normally left behind with little if any financial return. A third option being used is to replace the regular wet electric batteries with non-spillable types. Again, this is an expensive method as non-spillable types, previously referred to as gel cells, cost approximately twice that of regular batteries and in most cases do not perform as well. For some individuals who regularly use air transportation, a set of gel cells is purchased for use only while away from home. Upon returning, the gel cells are replaced with regular batteries and stored until the next flight.

It should be noted that due to their added weight and bulkiness, most electric wheelchairs are not considered to be portable in the same manner as a manual wheelchair. Whereas a manual chair can be loaded into the trunk of a passenger car with a certain amount of effort, the loading of an electric wheelchair would, in most cases, be avoided whenever possible. The normal method of transporting an electric wheelchair is in a modified van with provision for loading by means of a ramp or mechanical lift. The implication of this is that in areas where van service to and from the airport is not available, it may be more desirable to travel with a manual chair. However, some newer types of electric wheelchairs and scooters, which are designed to be more portable than the standard institution type chair, are now becoming a significant portion of the market.

2.3 Airline Practice

In most cases, airlines fly by the relevant regulations. In Canada and the United States however, two airlines have applied for and received exemption from the governing regulations for the transporting of wet electric storage batteries.

In the United States, Frontier Airlines received exemption over a year ago. Their method of transporting the batteries involves replacing the vent caps with special spill resistant caps. These caps, which are sold under the brand name of Tiltite, use gravity actuated valves that impede the flow of electrolyte when the battery is tilted. The battery is fitted with these caps, enclosed in a plastic bag and sealed. Frontier representatives contacted indicated that this procedure has been successful to date.

In Canada, Air Canada has recently received approval from Transport Canada on a trial basis, for their disposable package design. (See Appendix) The design involves replacing the regular vent caps with the Tiltite caps mentioned above. Absorbent pads are wrapped and taped around the battery and the unit is enclosed in a polyethylene bag and placed in a fibre board box with appropriate warning and shipping labels. No formal method of securing the package is provided, but suitable cargo is placed about the package to prevent tipping or shifting. As this exemption was just recently approved, no information under actual field use is available as of yet on this packaging method.

3. WHEELCHAIR BATTERIES

3.1 Types

Batteries for use in wheelchairs are referred to in the regulations under two main categories, either wet electric storage or non-spillable wet electric storage.

The majority of batteries used in wheelchairs are of the wet electric storage type. These batteries can be further broken down into categories such as deep discharge and maintenance free; but, for the purpose of this report, they all contain liquid electrolyte and are vented to the atmosphere.

Non-spillable wet electric storage batteries are not formally defined, but are intended to positively prevent leakage of electrolyte, irrespective of the battery position. Again, there are many designs for non-spillable batteries using techniques such as special filling and venting plugs, imobilized electrolyte and lead lined containers; but in the wheelchair market by far the most common method is the use of jelly type electrolyte. These batteries are commonly referred to as gel cells.

3.2 Size

Manufacturers of wheelchairs in most cases do not supply original batteries. They do give recommendations for group sizes and performance and the original batteries are supplied by the dealer. The most commonly suggest group sizes are 22NF, U1 and 24C with capacity ratings from approximately 36 to 50 amp-hr.

Generally, most full size wheelchairs now use two twelve-volt batteries; however, some wheelchairs use only one twelve-volt battery and some older models use one or two six-volt batteries. Also, the range of batteries in use is further complicated by the fact that the selection of replacement batteries is up to the user. If the batteries fit in the battery tray and are compatible with the voltage requirements of the system, then they will be considered by the purchaser. In some cases, the user ends up with batteries which are not well suited to the application. For instance, "maintenance free" batteries are sometimes purchased for use in wheelchairs, but their low antimony content decreases their ability to cycle through many deep discharges. Also, regular automotive batteries in most cases do not have the additional lead required in batteries designed for frequent deep discharges. The sizes and types of batteries used in wheelchairs are numerous and this must be taken into account when evaluating methods of improving the air transportation of electric wheelchairs.

3.3 Performance

As was pointed out in Section 3.2, there is a multitude of battery types in use in wheelchairs. The actual performance characteristics required are dependent upon the travel requirements of the user. Heavy usage may require large capacity batteries with nightly charging, whereas light usage may only require small capacity batteries with weekly charging. Properly designed batteries should be capable of withstanding approximately 150 to 200 deep discharge cycles before replacement, which under moderate use would equate to a lifetime of six to twelve months.

4. REQUIREMENTS FOR AIR TRANSPORTATION

The primary requirement for the air transportation of wet electric storage batteries is safety. The corrosive electrolyte must be contained to prevent damage to the aircraft body or controls. As well, the possibility of electrolyte combining with other substances being shipped in the hold must be prevented. Methods of eliminating the possibility of sparking due to short circuiting of the battery terminals are also necessary to prevent possible explosions and fire.

The conditions under which these requirements must be met include variations in temperature and pressure. Also, resistance to vibration and shock loading is required. Although in modern commercial passenger aircraft the cargo hold is heated and pressurized, the following variations in environment, as outlined in the IATA regulations, may be encountered.

Pressure:

Pressures equivalent to 3,050 m or 0.7 bar absolute may be experienced irrespective of actual flight level.

Temperature:

Temperature may vary from below 0°C on long, high altitude flights, to a maximum of 55°C on the ground, especially in tropical areas.

Vibration:

Vibration in commercial aircraft may range from 5 mm amplitude at 7 Hertz corresponding to 1 g acceleration, to 0.05 mm amplitude at 200 Hertz corresponding to 8 g acceleration.

Shock Loading:

Packages must be able to withstand a shock load equivalent to a drop from 1.2 m onto a rigid, non-resilient surface, as may be encountered during handling.

5. DISCUSSION OF PROPOSED OPTIONS

The four options as stated in the introduction and listed below for reference have been evaluated as to their suitability for ensuring that electric wheelchair users have full use of their wheelchair at the destination airport.

Option a) Availability of replacement wet-cell batteries at destination.
Option b) Alternative non-spillable batteries.
Option c) Special shipping container for wet-cell batteries.
Option d) Special non-spill plugs for wet-cell batteries.

Option a) Availability of replacement wet-cell batteries at destination.

Using this option, the traveller would either leave his personal batteries at home or check them at the airport before departing. Upon his arrival at the destination airport a set of loaner batteries would be supplied to the user for the duration of his stay. When returning, the user would drop off the loaner batteries before departure and install his personal batteries at the completion of the trip. This option requires the set-up of facilities at each airport devoted to supplying, maintaining, installing and storing wet electric storage batteries.

The supply of sufficient quantities of batteries to meet the needs of each airport would be difficult to estimate as at present the number of potential users is unknown. The number of electric wheelchair users utilizing air transportation may increase significantly with the initiation of this service. If this is the case, then the initial capital expenditure for the purchasing of batteries could be considerable. Also, the maintaining of inventory would require the regular purchasing of replacements to make up for losses due to expired batteries as well as expected losses due to theft and damage. These comments assume that only one facility will be established at each airport, but if each airline requires their own facility, then the order of magnitude will obviously be increased substantially.

In order to properly maintain these batteries, shops would have to be set up specifically for this task. These shops would have to conform to accepted safety standards, which would require equipment such as explosion proof ventilation, eyewash stations, shower stations and the appropriate operator protective gear. Equipment for the maintenance of the batteries would include battery chargers, hydrometers and associated testing instruments and tools. Provisions for neutralizing spills and corrosive residue on the battery would also have to be included. Qualified technical staff would be required to operate these shops.

The storage and retrieval of the user and loaner batteries would require the implementation of a system capable of providing batteries in a freshly charged state upon request. The system should be designed so that waiting time is kept to a minimum.

In summary, the option of providing wet electric storage batteries at the user's destination would require a large amount of capital outlay in order to establish the facilities. As well, operating costs associated with the staffing, maintaining and managing of these facilities would be substantial.

Option b) Alternative non-spillable batteries

This option would require that the users of electric wheelchairs equip their chairs with non-spillable wet electric storage batteries for flights in narrow body aircraft. Non-spillable batteries are accepted by IATA for transportation in narrow body aircraft, if they are properly packaged to protect against short circuiting and damage. Non-spillable batteries, as mentioned previously, are normally of the jelly type electrolyte design and are commonly referred to as gel cells.

Gel cell batteries have been available to electric wheelchair users for a number of years, but due to their high initial cost and lower capacity, they do not represent a significant portion of the market. The additional processing required for the manufacturer of gel cells, as well as their limited market, results in a much higher cost as compared to wet electric storage batteries. A typical 50 amp-hr. wet electric storage battery designed for deep discharge cycling costs an average of $90.00, whereas an equivalent battery in a gel cell design costs upwards of $230.00.

Most gel cells sold for electric wheelchair use have a lower am-hr. capacity than wet electric storage batteries. A typical gel-cell capacity rating is about 30 amp-hr., whereas a typical wet electric storage is about 50 amp-hr. However, at least one manufacturer in the United States is now marketing a gel cell with a comparable capacity of 55 amp-hr. As mentioned previously, this battery retails for upwards of $230.00 in Canada. On wheelchairs requiring two such batteries, the initial purchase price is substantial.

The performance of gel cells is also dependent on the method used to charge them. If they are continually undercharged as can happen when using a charger putting out a nominal 12 volts, as found on older style chargers, then the cells can be deformed to only accept this lower charge. Gel cells require a nominal 14 volt charge potential as found on newer model chargers.

A problem with gel cells that has not been adequately addressed in the fact that not all brands are entirely non-spillable. Although they are described in the IATA regulations, there is no present definition or certification programme to ensure that a gell cell is indeed non-spillable. In the proposed amendments to the U.S. Federal Register, this fact has been recognized and specific vibration and pressure differential tests have been proposed. Compliance with these tests would ensure that all brands are indeed non-spillable. In parallel with this is that at the present, airline personnel have no positive means of identifying batteries that are classed as being non-spillable. For instance, 'maintenance free' batteries which do not have any visible vent

caps, have been mistaken as being non-spillable with potentially hazardous results. As well, users with wheelchairs equipped with gel cells have been denied access because some gel cells are very similar in external appearance to wet electric storage batteries. A method of determining which batteries are non-spillable as well as a positive means of identifying these batteries would be advantageous to the safe transportation of non-spillable batteries.

As with Option a), qualified personnel would be required to connect and disconnect these batteries and to crate them as required.

In summary, the option of requiring the user to equip the wheelchair with non-spillable batteries has the drawback of extremely high cost in order to achieve equivalent performance. Also, there exists a need for a system of certifying and labelling the batteries as being non-spillable.

Oction c) Special shipping container for wet cell batteries.

This option would require that a special shipping container be designed to accommodate the majority of wet electric storage batteries. The purpose of these containers would be to provide a safe method of transporting wet electric storage batteries in narrow body aircraft.

The containers would have to be designed to provide safe transportation under the conditions and requirements as outlined in Section 4. In order to ensure that the requirements are met by the container, test procedures would have to be drawn up and a certification program established.

The distribution of these containers would most likely be handled as a joint agreement between participating airlines. The user, upon arrival at the airport, would turn his electric wheelchair over to the airline personnel who would ensure that the batteries have been properly disconnected and installed in the containers. This function would require qualified technical personnel. Each airline would have to ensure that it had sufficient quantities of containers to meet its expected needs. An alternative to this arrangement would be to supply the user with his own personal container. This, however, would create problems associated with maintenance of the container or improper packaging of the batteries by non-qualified personnel.

The expense involved in the design and manufacture of these containers would depend on the number of potential users as well as the level of technology required to achieve acceptable performance.

In summary, the design and manufacture of special containers for wet electric storage batteries would facilitate air transportation of electric wheelchairs. Cost considerations would depend on the level of technology required.

Option d) Special non-spill plugs for wet cell batteries.

Non-spill vent plugs are designed to prevent electrolyte leakage from the battery and yet allow the escape of gases generated within the battery as required.

The most common type available in sizes suitable for replacing standard wheelchair battery plugs are sold under the brand name Tiltite. These plugs use a valve that opens and closes depending on the orientation of the battery. When the battery is tipped or vibrated, the valve should close and prevent any spillage of electrolyte. Although these plugs do minimize the amount of electrolyte released under adverse conditions, they are more accurately described as being spill resistant. Spills of up to 50 ml have been encountered in worst case conditions. For this reason, these plugs cannot be relied upon as a stand alone system. As mentioned previously, Frontier Airlines and Air Canada are using them as part of their package design. On batteries where the vent holes are not readily accessible, such as 'maintenance free' type batteries, the use of these plugs is not always possible.

Another type of non-spill vent cap, which is used on aircraft batteries, employ a spring actuated plunger which only vents when there is a sufficient pressure differential to overcome the tension supplied by the spring. The problem associated with this method is that, at the present, these plugs will not fit batteries used in electric wheelchairs. Also, due to the limited market, there are no plans to manufacture these plugs in compatible dimensions.

In summary, the use of non-spill vent caps as the sole method of preventing electrolyte leakage during air transportation of wheelchair batteries is not a workable solution.

6.0 EVALUATION OF OPTIONS

The four options presented in Section 5 are evaluated and ranked as to their suitability of best meeting the defined requirement of ensuring that electric wheelchair users will have full use of their wheelchairs at the destination airport.

From least suitable to most suitable, the options are:

Option d) Special non-spill plugs for wet cell batteries

Option a) Availability of replacement wet cell batteries at destination

Option b) Alternative non-spillable batteries

Option c) Special shipping container for wet cell batteries

A summary of the advantages and disadvantages of the four options follow:

Option d) - Special non-spill plugs for wet cell batteries. Non-spill plugs using gravity controlled valves are only spill resistant as opposed to spillproof. In worst case situations, spills of up to 50 ml have occurred. This spillage is not acceptable for safe air transportation. Application on some non-conventional venting systems such as 'maintenance free' batteries is not always possible.

It should be noted that these plugs do lessen the chance of spillage and could be one element in a leakproof system.

Vent plugs using spring loaded valves, now being used on some aircraft batteries, do not fit wheelchair batteries in the majority of cases. Also, pressure differentials encountered in cargo holds may be sufficient to activate these valves in some situations.

Option a) - Availability of replacement wet cell batteries at destination.

The option requires a large capital expenditure for the set up and operation of proper facilities at each airport. Due to the low volume of expected electric wheelchair users, the system could not be economically justified.

Option b) - Alternative non-spillable batteries.

Non-spillable batteries are now available with performance characteristics similar to wet cell batteries; however, their high cost prohibits their use by the majority of electric wheelchair users. Also, the problem and costs involved in certifying and identifying these batteries as being non-spillable must be recognized.

Option c) - Special shipping containers for wet cell batteries. If an acceptable container can be designed, tested and manufactured at a reasonable cost, then this option is the most suitable for ensuring that the traveller has full use of his wheelchair at the destination airport. As with the other options, airline personnel must be sufficiently aware of and protected from the potential hazards involved in the handling of wet cell batteries.

7. CONCLUSIONS & RECOMMENDATIONS

Of the four options evaluated in this report, the option of using special shipping containers best fulfills the requirement that the electric wheelchair user has full use of his wheelchair at the destination airport.

As mentioned previously in this report, Air Canada has recently applied for and received permission to use their container design on a trial basis. It is suggested that information on the container design, under field use conditions, be regularly reviewed in order to facilitate its evaluation during the trial period. Also, if the proposed amendments to the U.S. regulations are accepted, regular monitoring should be carried out to assess their effect on electric wheelchair users and the airlines involved.

APPENDIX

Air Canada Wheelchair Battery Packaging System

This appendix describes Air Canada's packaging method for wheelchair batteries. The method is applicable to flights on narrow body aircraft (DC-8, DC-9, B727) and wide body aircraft (L-1011, B747) bulk hold, within Canada.

The procedure is described in detail in Air Canada's publication, Special Handling for Equipment Used by Incapacitated Passengers and the instructional posters which follow.

Briefly, the method involves the following steps:

1) Remove battery from wheelchair, tape terminals and any exposed wire ends with electrical tape.

2) Determine type of battery (gel type may be inserted directly into shipping box).

3) Seal vent holes on maintenance free batteries with putty and then tape.

4) Replace battery vent caps on regular batteries with non-spill caps (screw or push type).

5) Place two layers of absorbent "Kimpak" over the battery and secure with tape.

6) Place battery in its container.

7) Place battery and container in the plastic bag and seal with tape.

8) Place plastic bag in the shipping box with the original vent caps.

9) Seal and tag the shipping box.

Air Canada Wheelchair Battery Packaging System

Parts List

1	roll	electrical tape
1	roll	2" masking tape
1	roll	ACF824A Air Canada packing tape
1	roll	99920A1054 "Nortite" putty
6		M2 screw caps
6		M2PO push caps
2	sheets	99950A1009 "Kimpack"
1		polyethylene bag
1		100A65 cardboard battery shipping box

Special Handling for Equipment Used by Incapacitated Passengers

1 Wheelchairs (cont.)

.16 Battery Type: There are three basic types of batteries:

MAINTENANCE FREE BATTERY

This is labelled MAINTENANCE FREE and can be recognized by two square, non-removable caps and two vent holes (slits) on the top or sides of the caps. It is similar to a standard car battery and manufactured by various companies e.g. Delco, Auto-lite, Esso, etc.

WET TYPE LEAD ACID BATTERY

This is a standard car battery type and can be recognized by the removable caps. These caps can be either the SCREW type or the PUSH type.

GEL TYPE BATTERY

This is a non-spillable type of battery and it must carry a manufacture's label indicating that it is a GEL-TYPE battery. It has non-removable caps with small vent holes similar to wet-type batteries.

Manutention du matériel utilisé par les passagers handicapés

1 Fauteuils roulants (suite)

.16 Types de batteries: Il y a trois principaux types de batteries:

BATTERIES SCELLÉES (sans entretien)

Les batteries scellées se reconnaissent à leurs deux plaques-bouchons rectangulaires fixes et leurs deux fentes de mise à l'air libre situés sur le dessus ou les côtés des plaques-bouchons. Ces batteries, qui ne demandent pas d'entretien et qui sont semblables à des batteries normales d'automobiles, sont fabriquées notamment par Delco, Auto-lite et Esso.

BATTERIES AU PLOMB (ÉLECTROLYTE LIQUIDE)

Les batteries à plaques de plomb et à électrolyte liquide sont les batteries qui équipent normalement les véhicules automobiles et que l'on reconnaît à leurs bouchons démontables. Il existe deux types de bouchons: ceux qu'on visse et ceux qu'on enfonce.

BATTERIES À GEL ÉLECTROLYTIQUE

Les batteries à gel électrolytique sont étanches et doivent porter une étiquette du fabricant certifiant qu'elles sont bien de ce type. Ces batteries sont munies de six bouchons fixes percés de petits orifices de mise à l'air libre semblables à ceux que l'on retrouve sur les batteries ordinaires à électrolyte liquide.

Special Handling for Equipment Used by Incapacitated Passengers

Manutention du matériel utilisé par les passagers handicapés

1 Wheelchairs (cont.)

.17 Preparing Batteries on Electric Wheelchairs for Cargo Compartments:

MAINTENANCE FREE AND WET TYPE LEAD ACID BATTERIES

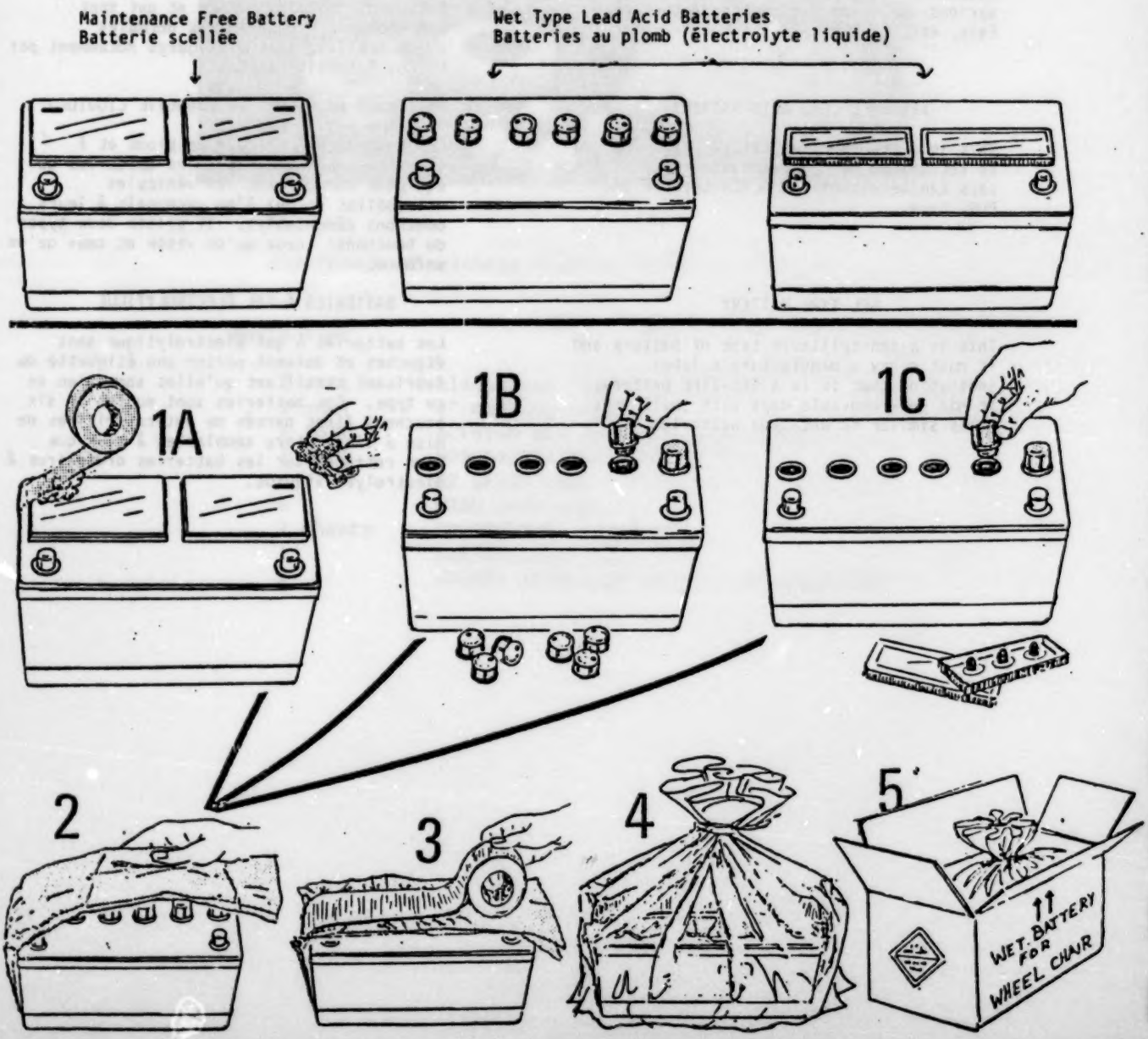
Determine what type of battery is used.

1 Fauteuils roulants (suite)

.17 Préparation des batteries des fauteuils roulants motorisés pour le transport en soute:

BATTERIES SCELLÉES ET BATTERIES AU PLOMB (ÉLECTROLYTE LIQUIDE)

Déterminer le type de la batterie à emballer.



Special Handling for Equipment Used by Incapacitated Passengers

1 Wheelchairs (cont.)

.17 Preparing Batteries on Electric Wheelchairs for Cargo Compartments: (cont.)

MAINTENANCE FREE BATTERY

1a Seal the vent holes (slits) with putty and hold it in place with 2" wide masking tape.

WET TYPE LEAD ACID BATTERY SCREW CAPS

b Remove screw-type battery vent caps and replace with screw type non-spillable vent caps (Part M2 Screw Cap).

WET TYPE LEAD ACID BATTERY PUSH CAPS

c Remove push-type battery vent caps and replace with push-type non-spillable vent caps (part M2PO Push cap).

2 Place two layers of Kim Pak over the top of the battery part no. 99950A1009.

3 Tape Kim Pak down with masking tape and ensure it is held firmly in place to prevent shifting.

4 Place battery in polyethylene bag and SEAL the bag by twisting and taping the top.

5 Place the sealed bag containing the battery in a specially labeled cardboard battery box along with the original battery vent caps and tape the box closed using Air Canada packing tape ACF824A.

GEL TYPE BATTERIES

1 Place battery in the specially labelled cardboard battery box.

NOTE: As this battery is non-spillable, no other preparation is necessary.

2 Tape the box closed using Air Canada packing tape.

Manutention du matériel utilisé par les passagers handicapés

1 Fauteuils roulants (suite)

.17 Préparation des batteries des fauteuils roulants motorisés pour le transport en soute: (soute)

BATTERIES SCELLÉES

1a Boucher les fentes de mise à l'air libre avec du mastic maintenu en place par de ruban-cache, de 2 po de large.

BOUCHONS DE TYPE VISSABLE - BATTERIES AU PLOMB (ÉLECTROLYTE LIQUIDE)

b Retirer les bouchons de mise à l'air libre dévissables et les remplacer par des bouchons de mise à l'air libre anti-écoulement vissables (pièce numéro M2 - bouchons de type vissable).

BOUCHONS DE TYPE ENFONÇABLE - BATTERIES AU PLOMB (ÉLECTROLYTE LIQUIDE)

c Retirer les bouchons de mise à l'air libre enfonçables et les remplacer par des bouchons de mise à l'air libre anti-écoulement enfonçables (pièce numéro M2PO - bouchons de type enponsable).

2 Recouvrir le dessus de la batterie de deux épaisseurs de Kim Pak (pièce numéro 99950A1009).

3 Avec du ruban-cache, fixer solidement le Kim Pak afin d'éviter tout risque de déplacement.

4 Emballer la batterie dans un sac de polythène. Fermer en rassemblant et en tordant la partie supérieure du sac et SCELLER avec de l'adhésif.

5 Mettre le sac scellé contenant la batterie dans un carton à batterie spécialement marqué, y placer les bouchons ou plaques-bouchons de mise à l'air libre d'origine et fermer la boîte en la collant avec de l'adhésif d'emballage d'Air Canada (ACF824A).

BATTERIES À GEL ÉLECTROLYTIQUE

1 Mettre la batterie dans un carton à batterie spécialement marqué.

REMARQUE: Ce type de batterie étanche ne nécessite aucun autre préparatif.

2 Fermer la boîte en la collant avec de l'adhésif d'emballage d'Air Canada.

Special Handling for Equipment Used by Incapacitated Passengers

1 Wheelchairs (cont.)

.17 Preparing Batteries on Electric Wheelchairs for Cargo Compartments: (cont.)

BATTERIES ENCLOSED IN SEPARATE BATTERY CASES

Determine what type of battery is used.

If the battery is the gel-type, leave it in the battery case, place the battery and battery case in the cardboard shipping battery box Part No. 100A65 and seal the box.

Manutention du matériel utilisé par les passagers handicapés

1 Fauteuils roulants (suite)

.17 Préparation des batteries des fauteuils roulants motorisés pour le transport en soute: (suite)

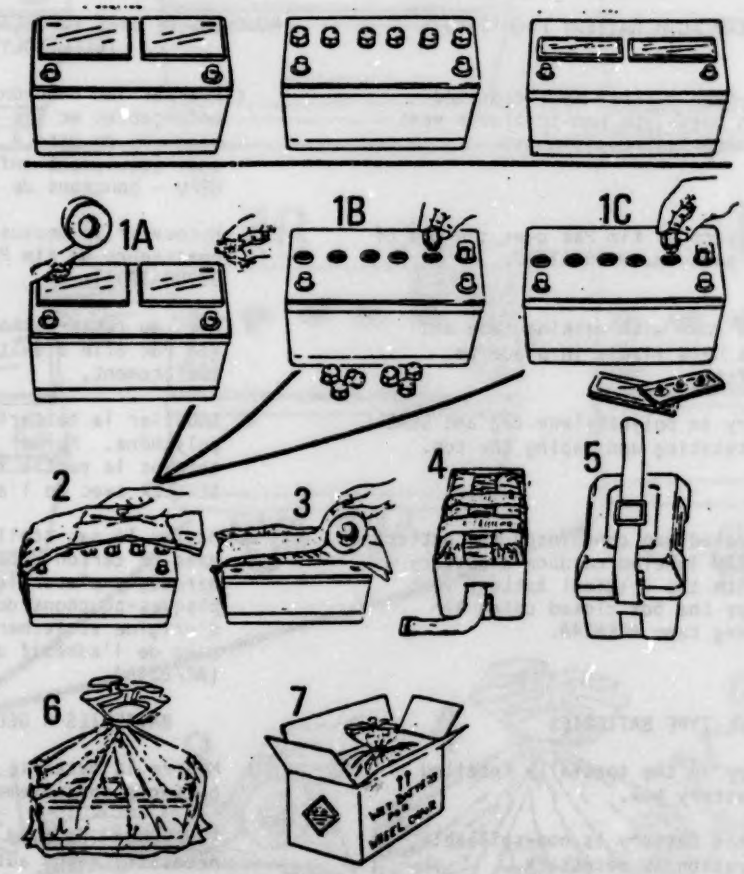
BATTERIES EN CONTENANTS INDIVIDUELS

Déterminer le type de la batterie à emballer.

S'il s'agit d'une batterie à gel électrolytique, la laisser dans son contenant, placer le tout dans un carton à batterie (pièce numéro 100A65) spécialement marqué et fermer avec de l'adhésif.

Maintenance Free Battery
Batterie scellée

Wet Type Lead Acid Batteries
Batteries au plomb (électrolyte liquide)



Special Handling for Equipment Used by Incapacitated Passengers

1 Wheelchairs (cont.)

.17 Preparing Batteries on Electric Wheelchairs for Cargo Compartments: (cont.)

MAINTENANCE FREE BATTERY

1a Seal the vent holes (slits) with NORTITE putty, part No. 9992OA1054 and hold it in place with 2" wide masking tape.

WET TYPE LEAD ACID BATTERY

b Remove screw-type battery vent caps and replace with screw type non-spillable vent caps (Part NO. M2 screw cap).

WET TYPE LEAD ACID BATTERY

c Remove push-type battery vent caps and replace with push-type non-spillable vent caps (part no. M2PO Push cap).

2 Place two layers of Kim Pak over the top of the battery Part No. 99950A1009.

3 Tape the Kim Pak down with masking tape and ensure it is held firmly in place to prevent shifting.

4 Place battery back in its battery container.

5 Secure battery container cover on battery box.

6 Place battery container in polyethylene bag and seal the bag by twisting and taping the top.

7 Place the sealed bag and content in a specially labelled cardboard battery box (along with the original battery vent caps) and tape the box closed using Air Canada packing tape ACF824A.

BATTERIES ENCLOSED IN DOUBLE BATTERY CONTAINERS

Remove batteries from container and pack separately in the specially labelled battery box using the procedures described above.

Manutention du matériel utilisé par les passagers handicapés

1 Fauteuils roulants (suite)

.17 Préparation des batteries des fauteuils roulants motorisés pour le transport en soute: (soute)

BATTERIES SCELLÉES

1a Boucher les fentes de mise à l'air libre avec du mastic maintenu en place par de ruban-cache, de 2 po de large.

BOUCHONS DE TYPE VISSABLE - BATTERIES AU PLOMB (ÉLECTROLYTE LIQUIDE)

b Retirer les bouchons de mise à l'air libre dévissables et les remplacer par des bouchons de mise à l'air libre anti-écoulement vissables (pièce numéro M2 - bouchon de type vissable).

BATTERIES AU PLOMB (ÉLECTROLYTE LIQUIDE)

c Retirer les bouchons de mise à l'air libre enfonçables et les remplacer par des bouchons de mise à l'air libre anti-écoulement enfonçables (pièce numéro M2Po - bouchon de type enfonsable).

2 Recouvrir le dessus de la batterie de deux épaisseurs de Kim Pak (pièce numéro 99950A1009).

3 Avec du ruban-cache, fixer solidement le Kim Pak afin d'éviter tout risque de déplacement.

4 Remettre la batterie dans son contenant.

5 Fixer solidement le couvercle du contenant.

6 Emballer le contenant dans un sac de polythène. Fermer en rassemblant et en tordant la partie supérieure du sac et sceller avec de l'adhésif.

7 Mettre le sac scellé dans un carton à batterie spécialement marqué, y placer les bouchons de mise à l'air libre d'origine et fermer la boîte en la collant avec de l'adhésif d'emballage d'Air Canada (ACF824A).

BATTERIES EN CONTENANT DOUBLE

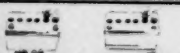
Retirer les batteries du contenant et les emballer séparément dans des cartons spécialement marqués en suivant la méthode énoncée ci-dessus.

ELECTRIC WHEELCHAIR HANDLING

NARROW BODY AIRCRAFT (DC-8, DC-9, B-727) – WITHIN CANADA ONLY

WIDE BODY AIRCRAFT (L-1011 & B-747) BULK HOLD – WITHIN CANADA ONLY

BATTERIES

	FIXED CAPS GEL TYPE	MAINTENANCE FREE	ALL TYPES WET LEAD ACID	
SEPARATE QUICK DISCONNECT WIRES OR REMOVE WIRES FROM BATTERY POSTS	✔	✔	✔	
TAPE WIRE ENDS AND LABEL (+ or –) *	✔	✔	✔	* USE ELECTRICAL TAPE ON BATTERY TERMINALS AND WIRE ENDS IF ATTACHED TO THE BATTERY. USE MASKING TAPE FOR LABELLING AND PACKAGING.
TAPE BATTERY POSTS *	✔	✔	✔	
REMOVE BATTERY/IES FROM WHEELCHAIR	✔	✔	✔	
PLACE WHEELCHAIR, BATTERY COVER, IN WHEELCHAIR BAG	✔	✔	✔	
CLOSE BAG AND SECURE WITH TAPE. TAG	✔	✔	✔	
SEAL THE BATTERY VENT HOLES WITH PUTTY. TAPE		✔		
REMOVE BATTERY VENT CAPS (SCREW OR PUSH TYPES). REPLACE WITH NON-SPILL TYPES			✔	
PLACE 2 LAYERS "KIMPAK" OVER BATTERY. THEN TAPE		✔	✔	
PLACE BATTERY IN ITS CONTAINER		✔	✔	
PLACE BATTERY (IN ITS CONTAINER) IN PLASTIC BAG. TWIST, AND SEAL WITH TAPE		✔	✔	
PLACE BATTERY AND VENT CAPS IN BATTERY BOX. SEAL AND TAG	✔	✔	✔	

LOADING

ALWAYS HANDLE AND LOAD BATTERIES IN AN UPRIGHT POSITION

DO NOT LOAD ANYTHING ON TOP OF WHEELCHAIR

LOAD CHAIR TO PREVENT MOVEMENT IN COMPARTMENT

CHAIRS LOADED ON SIDE MUST HAVE CONTROLS "UP"

CONFIRM NUMBER, LOCATION, DESTINATION AND TAG NUMBERS WITH LOAD AGENT

NOTE: WIDE BODY AIRCRAFT (L-1011 & B-747), PERMISSIBLE ALL SERVICES

- DISCONNECT BATTERY, ALL TYPES
- TAPE BATTERY TERMINALS AND WIRE ENDS
- INSERT WHEELCHAIR WITH BATTERY ATTACHED IN PLASTIC WHEELCHAIR BAG. TAG
- LOAD UPRIGHT IN LD3 CONTAINER

EMBALLAGE ET EXPÉDITION DES FAUTEUILS ROULANTS MOTORISÉS

AVIONS STANDARD (DC-8, DC-9, B-727) AU CANADA SEULEMENT
AVIONS GROS-PORTEURS (L-1011 ET B-747) SOUTE À VRAC — AU CANADA SEULEMENT

BATTERIES

	BOUCHONS FIXES À GEL ÉLECTROLYT.	SCELLÉE	TOUS LES TYPES AU PLOMB	
DÉCONNECTER LES ENCHEVÊTREMENTS RAPIDES OU DÉCONNECTER LES CÂBLES DES BORNES DE BATTERIES	✓	✓	✓	
COUVRIR LES COSSES DES CÂBLES ET MARQUER D'UN + OU D'UN — *	✓	✓	✓	* ON DOIT SE SERVIR DE RUBAN ISOLANT SUR LES BORNES DES BATTERIES AINSI QUE SUR LES COSSES DES CÂBLES QUI SONT ATTACHÉES AUX BATTERIES. LE RUBAN-CACHE SERT À IDENTIFIER LES COSSES POUR FACILITER LE REBRANCHEMENT.
COUVRIR LES BORNES DE LA BATTERIE DE RUBAN ISOLANT *	✓	✓	✓	
RETIRER LA/LES BATTERIES DU FAUTEUIL ROULANT	✓	✓	✓	
EMBALLER LE FAUTEUIL ET LA HOUSSE DES BATTERIES DANS UN SAC DE POLYTHÈNE	✓	✓	✓	
RABATTRE LA PARTIE SUPÉRIEURE DU SAC ET LA FIXER AVEC DU RUBAN ADHÉSIF . ÉTIQUETER	✓	✓	✓	
BOUCHER LES FENTES DE MISE À L'AIR LIBRE DES BATTERIES AVEC DU MASTIQUE. FIXER AVEC DU RUBAN-CACHE DE 2 POUCES.		✓		
RETIRER LES BOUCHONS DE MISE À L'AIR LIBRE, DÉVISSABLES ET ENFONÇABLES. REMPLACER PAR DES BOUCHONS ANTI-ÉCOULEMENT			✓	
RECOUVRIR LE DESSUS DE LA BATTERIE DE DEUX ÉPAISSEURS DE KIMPAK. FIXER AVEC DU RUBAN-CACHE DE 2 POUCES		✓	✓	
REMETTRE LA BATTERIE DANS SON CONTENANT		✓	✓	
EMBALLER LA BATTERIE (DANS SON CONTENANT) DANS UN SAC DE PLASTIQUE. FERMER LE SAC ET SCELLER AVEC DE L'ADHÉSIF		✓	✓	
METTRE LE SAC SCELLÉ DANS UNE BOÎTE SPÉCIALEMENT MARQUÉE. Y PLACER LES BOUCHONS D'ORIGINE. SCELLER ET ÉTIQUETER	✓	✓	✓	

EXPÉDITION

LES BATTERIES DOIVENT TOUJOURS ÊTRE À L'ENDROIT, TANT POUR LA MANIPULATION QUE POUR LE RANGEMENT EN SOUTE

NE RIEN EMPILER SUR UN FAUTEUIL ROULANT

ARRIMER SOLIDEMENT LE FAUTEUIL EN SOUTE POUR ÉVITER QU'IL NE SE DÉPLACE DURANT LE VOL

S'IL FAUT ABSOLUMENT RANGER LE FAUTEUIL À L'HORIZONTALE, TOUJOURS FAIRE EN SORTE QUE LES COMMANDES SOIENT PLACÉES VERS LE HAUT.

COMMUNIQUER À L'AGENT AU CHARGEMENT LE NOMBRE, LA SOUTE ET LE NUMÉRO DES ÉTIQUETTES DE BAGAGE.

REMARQUE: AVIONS GROS-PORTEURS — PERMIS SUR RÉSEAU COMPLET

- DÉCONNECTER LES CÂBLES DES BORNES DE LA BATTERIE (TOUS LES TYPES)
- COUVRIR LES BORNES DE LA BATTERIE AINSI QUE LES COSSES DES CÂBLES DE RUBAN ISOLANT
- EMBALLER LE FAUTEUIL DANS UN SAC DE POLYTHÈNE.
- CHARGER DANS UN CONTENEUR LD3 EN POSITION VERTICALE